

Scientific Inquiry

5-1 The student will demonstrate an understanding of scientific inquiry, including the foundations of technological design and the processes, skills, and mathematical thinking necessary to conduct a controlled scientific investigation.

5-1.1 Identify questions suitable for generating a hypothesis.

Taxonomy Level: 1.1-C Remember Procedural Knowledge

Previous/Future knowledge: In 3rd grade (3-1.3), students generated questions such as “what if?” or “how?” about objects, organisms, and events in the environment and use those questions to conduct a simple scientific investigation. In 4th grade (4-1.3), students summarized the characteristics of a simple scientific investigation that represent a fair test (including asking a question that identifies a problem). Students have not been introduced to the concept of hypothesis prior to this grade. In 7th grade (7-1.2), students will generate questions that can be answered through scientific investigation. In 8th grade (8-1.4), students will generate questions for further study on the basis of prior investigations.

It is essential for students to know that only *testable questions*, which are used to test one variable, are suitable for scientific investigations. The question should include the relationship between the *independent* (manipulated) variable and *dependent* (responding) variable. For example, the following are testable questions:

- How does the amount of space affect the population of fish in a pond?
 - The independent (manipulated) variable is size of the pond.
 - The dependent (responding) variable is the population of fish in the pond.
- What is the effect of slope of the land on the amount of soil erosion?
 - The independent (manipulated) variable is the slope of the land.
 - The dependent (responding) variable is the amount of soil erosion.
- How does stirring affect the rate that salt dissolves in water?
 - The independent (manipulated) variable is the stirring.
 - The dependent (responding) variable is the time to dissolve.

It is also essential for students to know that a prediction about the relationship between variables is formed from the testable question. This prediction is called a *hypothesis*.

- All controlled investigations should have a hypothesis.
- A hypothesis can be stated positively or negatively. For example,
 - The smaller the pond, the smaller the population of fish. (negative statement)
 - The greater the slope of the land, the more soil erosion will be observed. (positive statement)
 - The faster the stirring, the shorter amount of time it will take to dissolve the salt. (positive statement)
- A hypothesis can also be stated as a cause-and-effect (“If...then,...”) statement. For example, “If there is more food available, then the population of fish will increase.”
- The experiment is conducted to support or not support a hypothesis. If the hypothesis is not supported by the experiment, it can still be used to help rule out some other ideas.

NOTE TO TEACHER: In 4th grade (4-1.3), students generated predictions to the testable questions. In 5th grade, students will continue to generating these predictions, but use the term hypothesis.

It is not essential for students to conduct an investigation for every question they generate or generate questions based on prior investigations.

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Assessment Guidelines:

The objective of this indicator is to *identify* questions suitable for generating a hypothesis; therefore, the primary focus of assessment should be to recognize a question that leads to a hypothesis. However, appropriate assessments should also require students to *recognize* an appropriate hypothesis from a testable question or investigation; *recognize* that a testable question should have a manipulated and responding variable; or *identify* the manipulated and responding variables in a question.